OPTICS

NAVAL SEA SYSTEMS COMMAND

NAVSEA DAHLGREN Surface Warfare Center Division

NAVAL SURFACE WARFARE CENTER, DAHLGREN DIVISION

DAHLGREN PANAMA CITY DAM NECK

Overview

Basic research in areas critical to the Navy is one of the major reasons NSWCDD exists. The Optics Research team at NSWCDD, at the request of the Office of Naval Research, the Office of Naval Intelligence, the US Air Force, the Joint Program Office, and others, has been conducting research in such areas as laser scattering in turbid media, laser protection goggles, underwater imaging systems, ocean wave slope measurements, and photonic crystals.

Each successful experiment has furthered the development of the tools of the 21st Century Navy. Results have been used to increase the quality and quantity of the information from the Navy's active remote imaging systems; to protect pilots and other personnel from any harmful effects of exposure to laser beams; to supply the Air Force with instantaneous information about the condition of runways at remote locations during hostile situations; and to increase the effectiveness of lasers used in reconnaissance and underwater mine sensors.

The Optics Research team at NSWCDD has the experience, technology, and knowledge to supply answers to some of the basic research questions needed today to enable future capabilities.

Past Successes

- *Quick Look Evaluation for US Air Force*
  Use of electro-optical systems to remotely determine the condition of runway pavement during hostile situations
- *Optical Equipment Testing*
  Testing of optical equipment to determine the effects from exposure to various light sources. Sources included broadband and lasers
- *Coherence Properties of Light Scattered in Random Media*
  Investigation of how laser light is affected by particles randomly suspended in a medium such as smoke, fog, or water to determine ways to overcome the resulting distortion in images. Two patents awarded.
- *Portal Shield*
  Fielded 3 laser-based bio-detection systems worldwide. Patent pending
- *JBrews Bio-Detection System*
  Developed improved bio-detection system using CCD technology to miniaturize and improve performance. Deployment scheduled for FY00.

Current Projects

- *Underwater Imaging from Laser Based Remote Sensing Systems*
  Mine countermeasures effort to improve capability to detect, classify, and localize underwater mines and improve the chances of destroying them by removing the blur (caused by wave action) from a remote sensing systems image.
- *Multi-Line Laser Protection Goggles*
  Development of nonlethal countermeasures to produce laser protection goggles to protect pilots and other personnel.
- *Multiple Scattering Efficiency and Optical Extinction*
  Investigation to determine the maximum and minimum scattering and/or absorption efficiency of small particles randomly orientated in a surrounding medium. Applications include stealth, identification of friend or foe, and laser countermeasures as well as coherent backscatter, localization of light, and cavityless lasers. Two patents pending.
- *Photonic Collodial Crystals*
  Currently learning how to grow these crystals to determine the best size and composition for optimal optical properties including optical switching, optical power limiting, and optical logic gates.
- *Advanced Beam Control System Demonstrator Testing*
  Developed for space based ballistic missile defense by NSWCDD, this is the premier test bed for beam control concepts used by spacebased laser weapon systems. It includes a 60 cm diameter mirror, a deformable mirror, and outgoing wavefront sensor and diagnostic equipment.
- *Investigation of Carbon Nanotubes for Light Extinction Measurements*
  Performing optical extinction measurements, the results can be used for stealth applications.
- *Portable Optical Bio-Detection System*
  Development of personnel portable optical bio-detection system to supplement large fleet sized systems.

Capabilities

- Time Correlated Single Photon Counting
- Modecular Anisotropy Measurements
- LIDAR
- Two-Photon Spectroscopy (Modulated or Time-Resolved)
- Heterodyne Detection
- Ultra-Fast Pulse Shape Analysis
- Imaging and Image Analysis (UV-IR)
- Scattering of Electromagnetic Radiation by Random, Dense Media
- Optical Design
- Photonic Crystals
- Laser Hardening
- Space-Based Laser
- Radiative Transport
- Optical Phase Conjugation

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